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13. ABSTRACT ***(Maximum 200 Words)***

Multi-Agent Distributed Goal Satisfaction, MADGS, is a JAVA-based mobile-agent system under development to facilitate distributed mission planning and execution in complex dynamic environments with a focus on distributed goal satisfaction. The MADGS system represents the union of five separate components, Agent-Server (named Carolina), mobile-agents, Distributed Goal Satisfaction (DGS), agentTool, and Prodigy. The target real-world operational environment for the MADGS system is a network topology consisting of intermittent nodes and uncertain network connections that exist in a large-scale, multi-platform dynamic network. The resulting design developed for this environment addresses the communications issues faced when handling massive numbers of mobile-agents in such a topology. Our primary contribution to date has been examining the communications infrastructure requirements and changing how real-time mission planning and execution can be achieved without re-planning in the face of plan failures.

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AFOSR Project Final Report

Project Title: Large-Scale, Multi-Agent, Distributed Mission Planning and Execution in Complex Dynamic Environments
PI: Eugene Santos Jr., University of Connecticut
AFOSR Grant No. F49620-99-1-0244
AFOSR PM: Dr. Robert Herklotz

Final Project Summary

Goal: Facilitate distributed mission planning and execution in complex dynamic environments with a focus on distributed goal satisfaction

Approach: Utilize multi-agent systems, mixed-initiative systems, and intelligent resource substitution to avoid costly plan failures

Multi-Agent Distributed Goal Satisfaction, MADGS, is a JAVA-based mobile-agent system under development to facilitate distributed mission planning and execution in complex dynamic environments with a focus on distributed goal satisfaction. The MADGS system represents the union of five separate components, Agent-Server (named Carolina), mobile-agents, Distributed Goal Satisfaction (DGS), agentTool, and Prodigy. The target real-world operational environment for the MADGS system is a network topology consisting of intermittent nodes and uncertain network connections that exist in a large-scale, multi-platform dynamic network. The resulting design developed for this environment addresses the communications issues faced when handling massive numbers of mobile-agents in such a topology. Our primary contribution to date has been examining the communications infrastructure requirements and changing how real-time mission planning and execution can be achieved without re-planning in the face of plan failures.

For real-time planning and execution, we developed the ability to autonomously handle changes in the constraints of a plan which can mean the success or failure of any distributed operational mission/goal. The need to re-plan or backtrack due to constraint changes in any plan can mean a substantial resource loss; be it lost capital or life, the expense is real. Our approach seeks to mitigate a significant amount of this loss by preemptively expecting failure, defining alternative constraint configurations, developing delivery arrangements and in the event of a failure offering a near instant solution instead of re-planning. Basically, our approach is to model resources as having interchangeable attributes for application to different tasks. When plan failure occurs due to resource failures, different resource agents much like quartermasters, etc., work together and negotiate quickly how alternative resources may be found and used. When combined with a human at the scene so to speak, decisions can be quickly made and implemented.

Major Accomplishments

- Developed JAVA-based mobile-agent system consisting of five integrated components -- Agent-Server (named Carolina), mobile-agents, Distributed Goal Satisfaction (DGS), agentTool, and Prodigy.
- Demonstrated ability to conduct mission planning and execution for multiple missions in one single scenario.
- When plan failure occurs due to resource failures, different resource agents much like quartermasters, etc., work together and negotiate quickly how alternative resources may be found and used.
- Developed MADGS prototype distributed mission planning and execution environment.

Publications [4 journal articles, 2 book chapters, and 34 conference papers]
[The publications below were supported in full or in part by this project.]

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